

# Ridership and Revenue Forecasting

## Response to Review

*presented to*

**California High-Speed Rail  
Authority**

*presented by*

**Cambridge Systematics, Inc.**

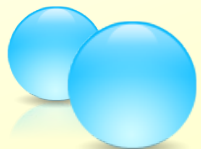
**Lance Neumann, Ph.D.**

**President**

**Kimon Proussaloglou, Ph.D.**

**Principal**

**July 8, 2010**



# Cambridge Systematics

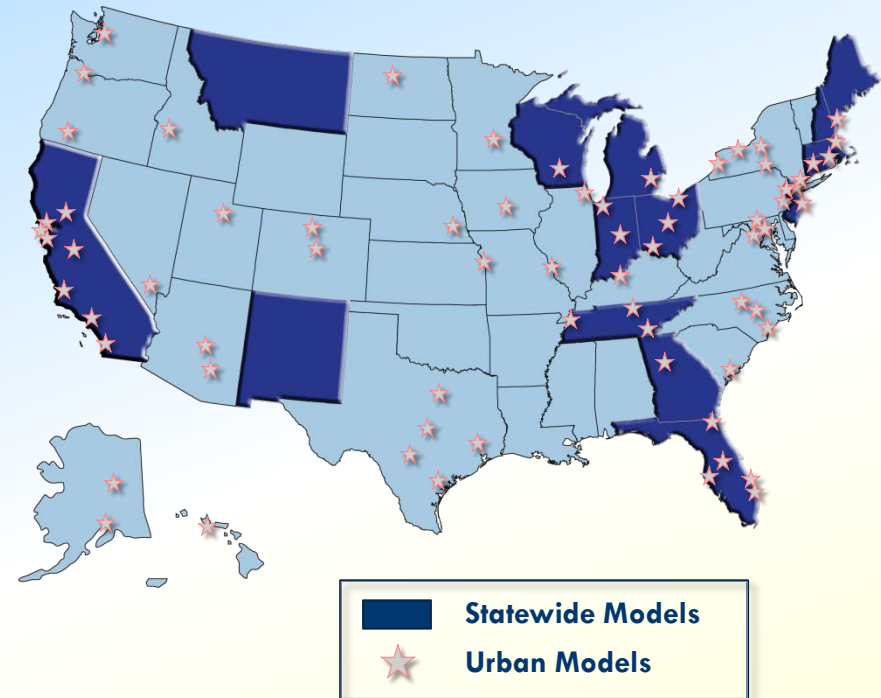
## A Legacy of Excellence and Trust

- **Founded in 1972, independent and employee-owned**
- **Full-service transportation planning firm with real-world experience**
- **Hundreds of clients worldwide**
  - » **Depth of analytic skills**
  - » **Objectivity**
- **Research and practical applications**

# Cambridge Systematics

## Travel Demand Forecasting Leadership

- Over 35 years of national and international experience
- Largest travel demand forecasting firm in the U.S. (50+ staff)
- Pioneered many of the most significant advances in the travel demand forecasting profession
- Practical worldwide experience
  - » 16 statewide & 30+ urban models
  - » High-speed rail models in both the U.S. and abroad



# Cambridge Systematics

## Model Development and Application Leadership

- **We *do***

- » Consider the specific policy and decision-making context in determining the appropriate modeling approach
- » Explain the necessary balance among model theory, practicality, complexity, and cost to our clients
- » Ensure that the modeling approach is consistent with an agency's schedule and resource constraints while meeting appropriate professionals standards

- **We *do not***

- » Assume a “one size fits all” theoretical approach is right for each ridership forecasting problem
- » Include unneeded features that would adversely affect model performance and cost

# Cambridge Systematics

## Training and Guidance Leadership

- **Travel Survey Manual  
(U.S. DOT)**
- **Model Validation Guide  
(U.S. DOT)**
- **Advanced Travel Demand  
Forecasting course (U.S. DOT)**
- **Transportation and  
Land Use course (U.S. DOT)**

### Travel Survey Manual

June 1996

#### Prepared by

Cambridge Systematics, Inc.

#### Prepared for

U.S. Department of Transportation  
Federal Transit Administration  
Federal Highway Administration  
Office of the Secretary  
U.S. Environmental Protection Agency

**The Travel Model  
Improvement  
Program**

### Travel Model Validation and Reasonability Checking Manual

*Helping Agencies Improve Their Planning Analysis Techniques*

**TMIP**  
Travel Model Improvement Program

# Cambridge Systematics

## Transportation Research Leadership

- **Transportation Research Board (National Academy of Sciences)**
  - » **Transportation Demand Forecasting**
  - » **Travel Survey Methods**
  - » **Travel Behavior and Values**
  - » **Travel Analysis Methods**
  - » **Statewide Transportation Data and Information Systems**
  - » **Intercity Passenger Rail**



# Cambridge Systematics

## California High-Speed Rail Ridership and Revenue Forecasting

- **Expert Model Development Team**
  - » Assembled internationally recognized team that has developed high-speed rail forecasts in Europe, Australia and the U.S.
  - » Convened an independent peer review panel of academic and practitioner experts
  - » Client project manager, Chuck Purvis, is a recognized national leader
- **Ridership and Revenue Model**
  - » State-of-the-art
  - » Appropriate blend of theory and judgment
  - » Realistic, proven sensitivities to key inputs
- **Confident the model is the right tool to support the Authority**

# Response to ITS Review

## Overview

- **Initial review generated 30 questions**
- **Issues discussed in the final report**
  - Division into short and long trips
  - Assigning all business travel to peak period
  - Treatment of panel dataset
  - Constraining the headway coefficient
  - Absence of an airport/station choice model
  - Calibration of constants in mode choice models
  - Constraining of coefficients
- **A complex system of models**
- **Data, models, calibration, and sensitivity**

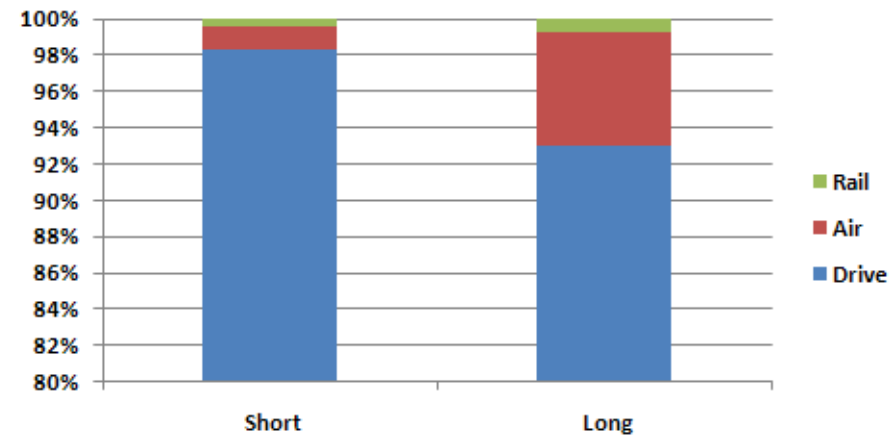


# Issue 1:

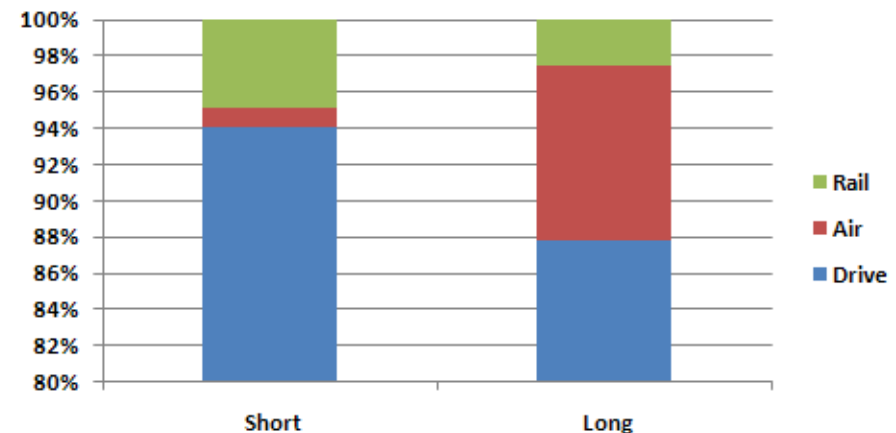
## Division into Short and Long Trips

- **Market segmentation**
- **Travel behavior by distance**
- **100 miles as a cutoff point**
- **Consistent with nationwide FHWA surveys**
- **Reflection of market segments and traveler tradeoffs**

**Business/Commute Travel**



**Recreation/Other Travel**



## Issue 2:

# Assigning All Business Travel to Peak Period

- **Majority of business travel occurs during the peak**
- **Similar patterns in urban and interregional travel**
- **Model properly reflects**
  - » **Total market size**
  - » **Size of work and nonwork market segments**
  - » **Service and costs during peak and off-peak periods**

# Issue 3:

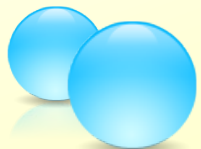
## Treatment of Panel Dataset

- **Two questions in the ITS review**
  - » The relative values of the policy sensitive parameters
  - » The statistical significance of the estimated parameters
- **Relative importance is key to policy-sensitive models**
  - » Parameters are consistent and free of bias
  - » Relative importance of parameters is correct

# Issue 4:

## Constraining the Headway Coefficient

- **Components of out-of-vehicle time**
  - » Access time, Wait time, Terminal time, and Egress time
  - » Schedule convenience: Headway component
- **High speed rail: a different paradigm of service frequency**
  - » Headways are shorter than best commuter rail operations
  - » Headway coefficient within range discussed with peer panel
- **Reasonable value leading to a policy-sensitive model**



# Issue 5: Absence of Airport/Station Model

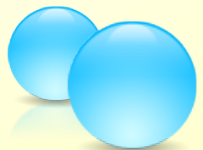
- CS method considers station and airport choice
  - » Access and level of service by station/airport
  - » Same station/airport is assigned to all travelers in the same zone
- A model assigns travelers to 2<sup>+</sup> airports/stations
- Magnitude of impact is estimated at less than 1%



# Issue 6:

## Calibration of Constants

- **Two inter-related questions**
- **Data: Represent all travel modes**
  - » Oversampling key segments
  - » Requirement for reliable model estimation
- **Method: Reflects true shares in population**
  - » Calibration of mode constants
  - » Adjustment for oversampling by mode

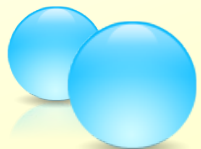




# Issue 6:

## Calibration of Constants - Data

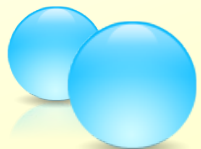
- **Data options examined at outset of project**
- **A random sample for the study**
  - » Caltrans household survey (N=17,000 households)
  - » A minimal sample size for air and rail riders (N=25)
- **Enriched sampling**
  - » New revealed and stated preference surveys
  - » 3,000 surveys with 1,500 auto users
  - » On-board and airport terminal surveys
  - » Data used to develop reliable choice models



# Issue 6:

## Calibration of Constants - Methodology

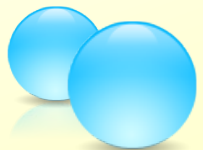
- **Need to correct back to true population market shares**
  - **Method: Calibrating mode constants**
  - **Reflects true market shares in population**
- **What is the source of disagreement?**
  - **Proven method was used to calibrate models**
    - ◆ Well established in literature and in practice
  - **New academic research from 2008**
    - ◆ Method not widely used in practice
- **Data are enriched to meet project objectives**
- **Model is representative of the population**



# Issue 7:

## Constraining of Coefficients

- **Model calibration to match observed travel**
  - » Adjustments to mode and airport constants
  - » Constraints only on few explanatory variables
- **Empirical evidence was used extensively**
  - » Decisions made to reflect base-year results
  - » Reconciling of different sets of data sources
  - » Published literature and accepted practice
- **Limited constraining of explanatory variables**
- **No impact on model validity**



# Summary

- **Creative tension**
  - » **Academic approach vs. real-world application**
  - » **We “followed generally accepted professional standards in carrying out the demand modeling and analysis”**
- **We disagree with other broad conclusions**
  - » **Data reflect travel among California residents**
  - » **Model validity is not compromised by econometric issues**
  - » **A policy-sensitive model addresses planning questions**
  - » **Model sensitivity has been proven in 3<sup>+</sup> years of application**
- **We fully stand behind the CAHSRA travel demand model**